Duke Stakeholder Meeting

May 19, 2008

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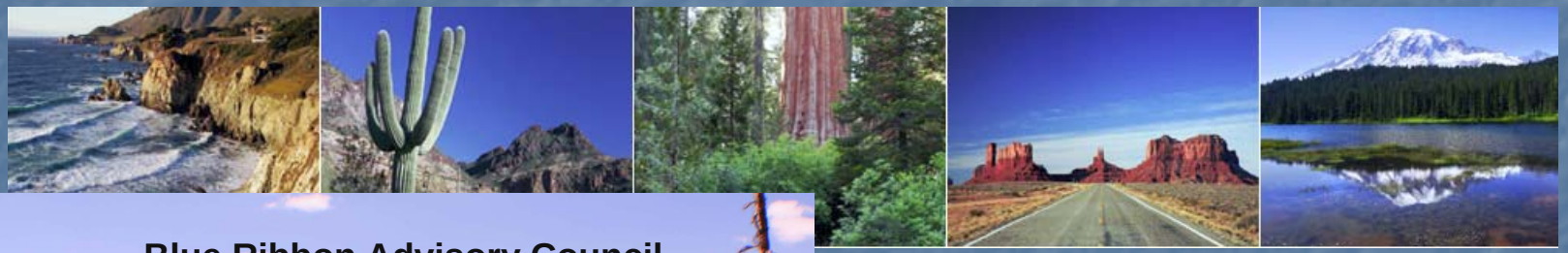
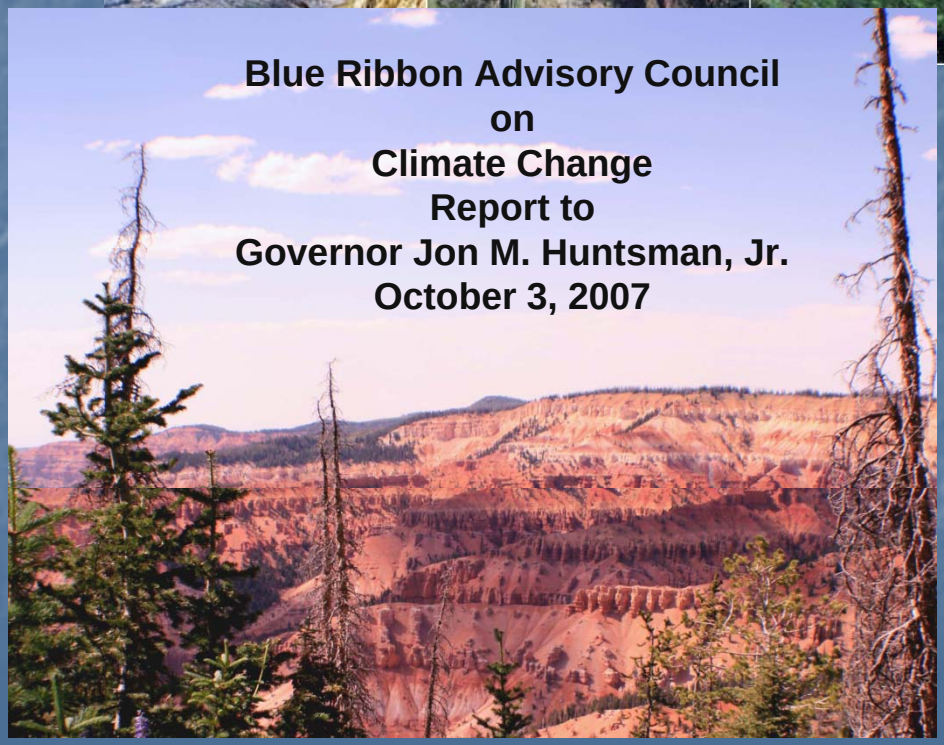
Road Map

- Put presentation context
- New Ag-Forestry Sink Inventory
- How we evaluated Strategies
- Emission Reductions and Costs
- Themes

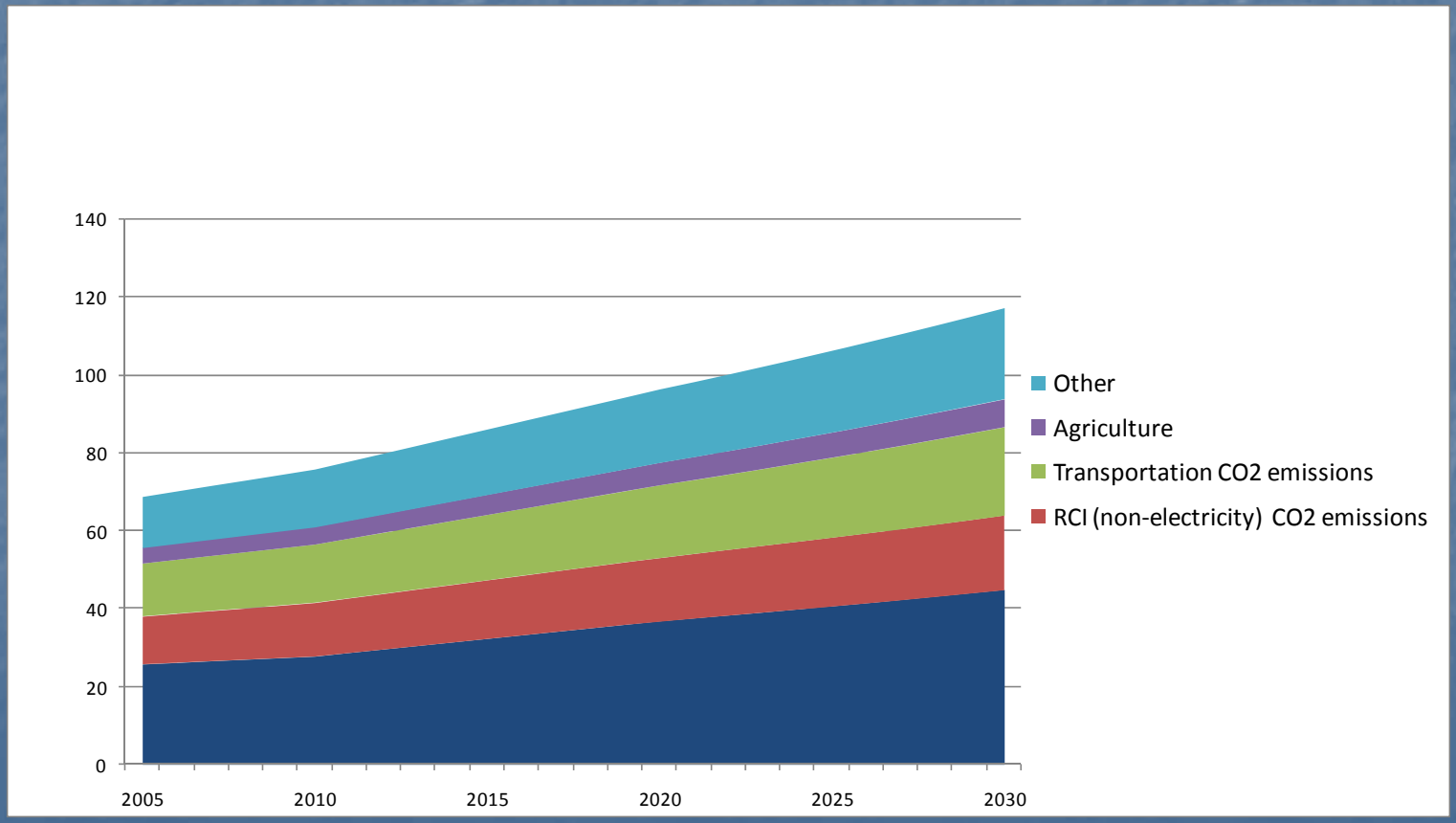
Western Climate Initiative



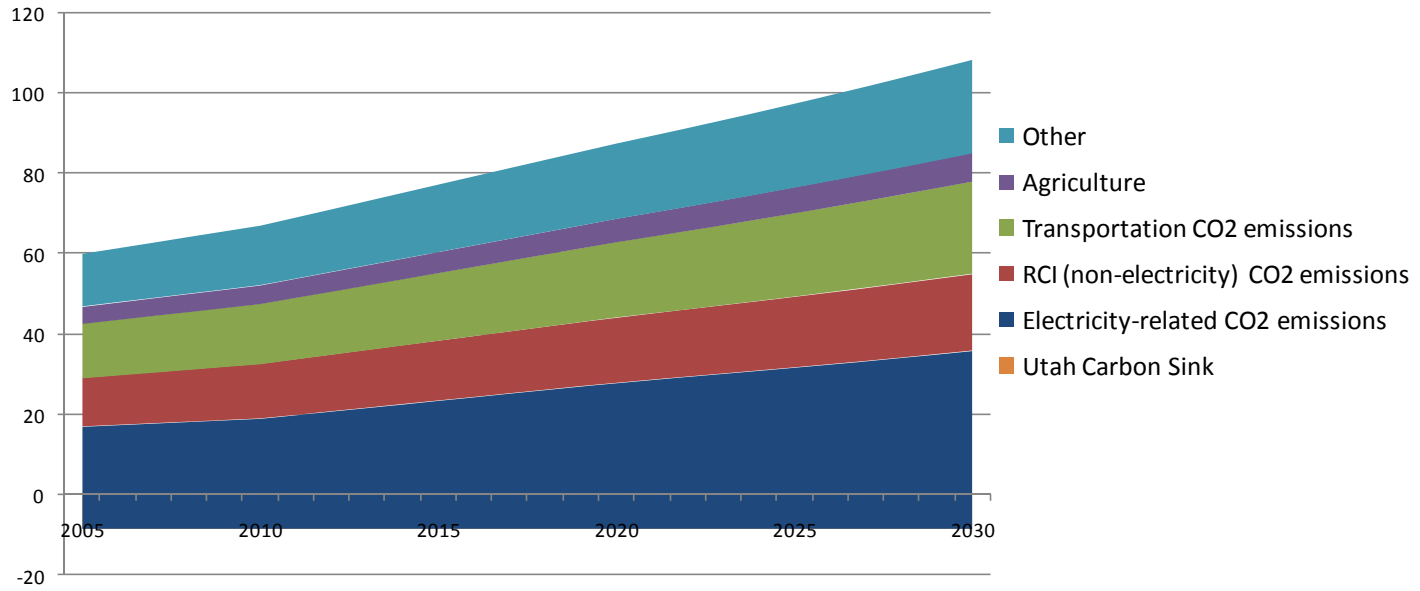


- Evaluation of Various GHG Reduction Strategies
- State Commitment to set a GHG Reduction Goal

Utah Emissions Inventory



Utah Emissions Inventory with Sink



The Challenge of the Evaluating 72 BRAC Strategies

- Relatively Short Timeline
- High Quality Work
- Importance for Policy Input

The Compromise

- Focused on subset of strategies base on the following:
  - Support of the BRAC
  - Avoided emissions potential
  - Preliminary cost estimates
  - Conversations with DEQ

Categories of Strategies

- Major Strategies
  - Examples – clean car and RPS
- Strategies with Smaller Potential
  - Examples – community trees and training building managers
- Enabling Strategies
  - Examples – public education and R&D

Strategies with Smaller Reductions May Be Highly Desirable

- Co-benefits
- Lower costs
- Small strategies add up

Theme #1 – Uncertainty

- What sort of future should we assume for the baseline case?
- How far will Utah want push various strategies?
- How will they be implemented?
- How will technology develop?

Strategy Evaluation Methodology

AURORAxmp®
EPIS, Inc.

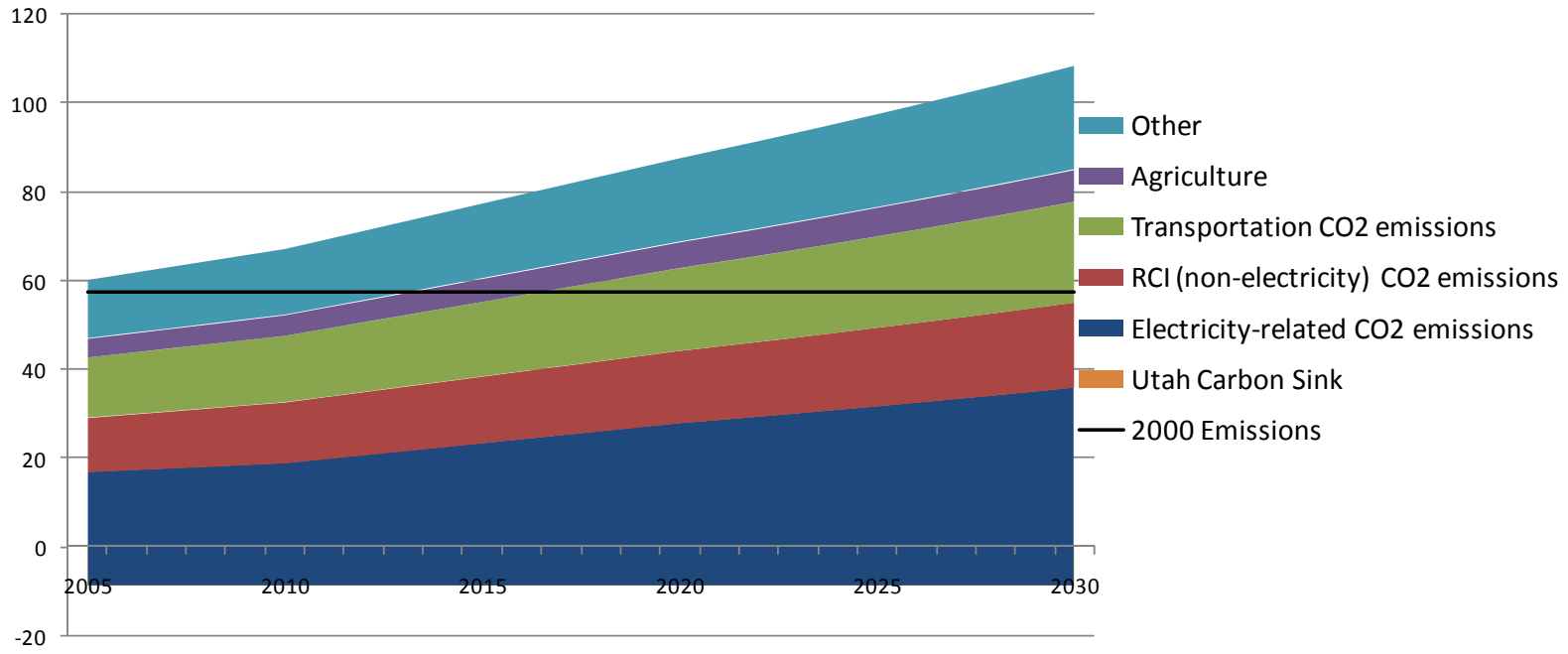
MWh

BASELINE:	1990	1991	1992	1993
Residential	4,584,480	4,804,367	4,892,291	5,123,151
Commercial	4,874,385	5,099,450	5,381,192	5,441,854
Industrial	6,225,724	6,329,559	6,745,021	6,743,915
Transportation	0	0	0	0
Other	944,452	902,114	970,970	975,746
Total	16,629,041	17,135,490	17,989,474	18,284,666

Methodology – Continued

- MOBILE6 On-Road Vehicle Emissions Model
  - Baseline/Strategies
- NEMS model
  - One transportation strategy
- Many consultations with experts in Utah
  - Technical Team and individual consultations
- Literature Review

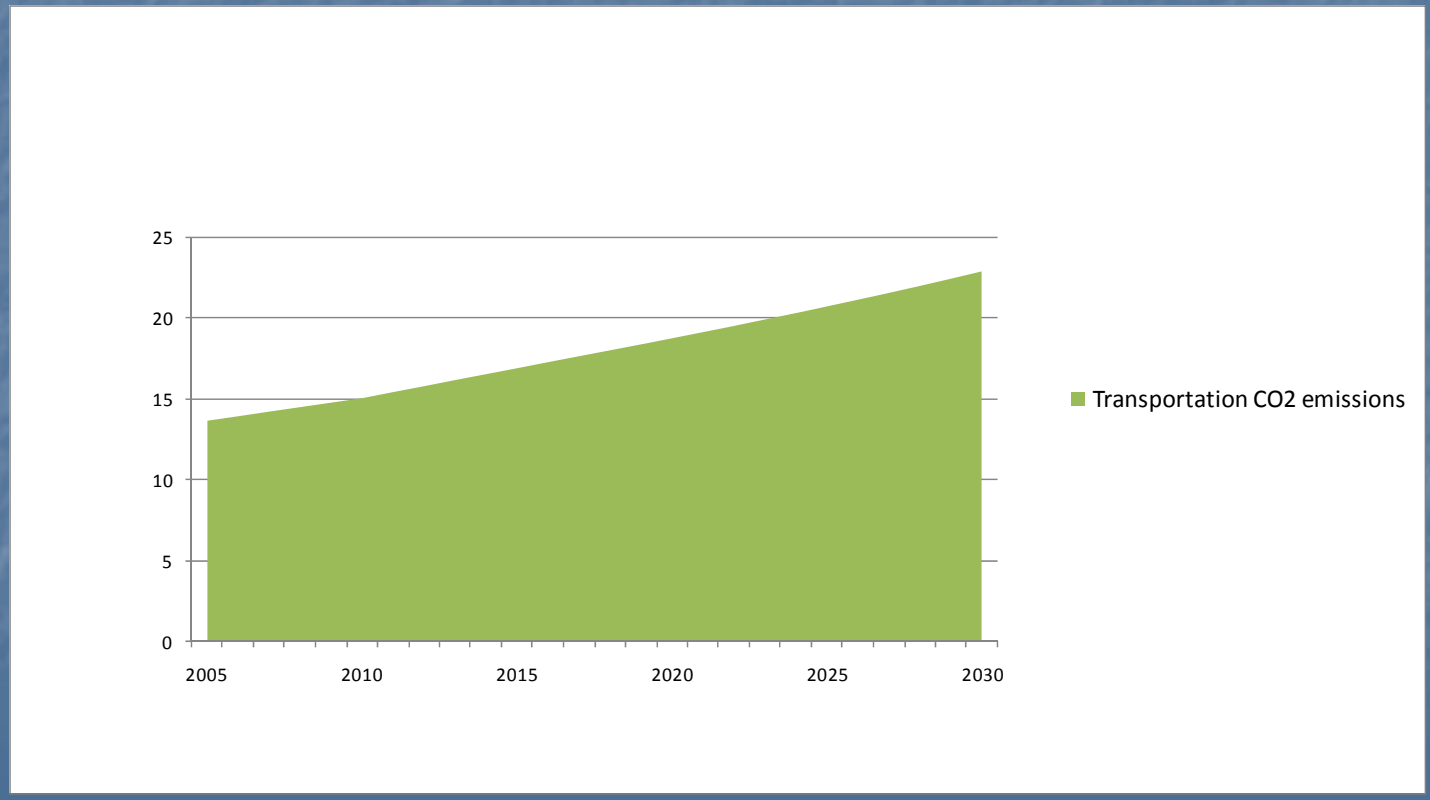
Inventory with 2000 Utah Emissions



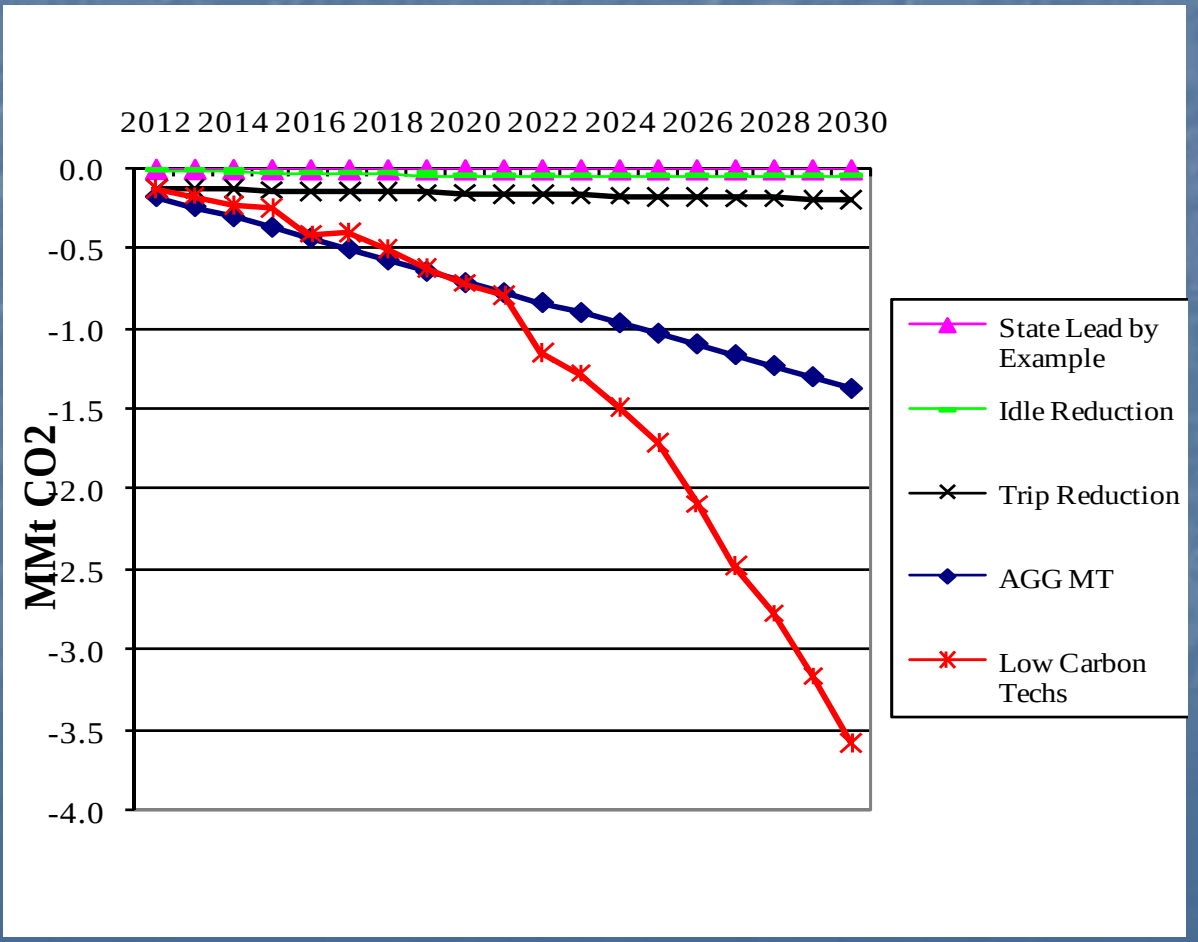
Transportation Sector

- Utah's second largest contributor to GHGs
- Spreadsheet approach to most strategies
- Models did inform a number of strategies

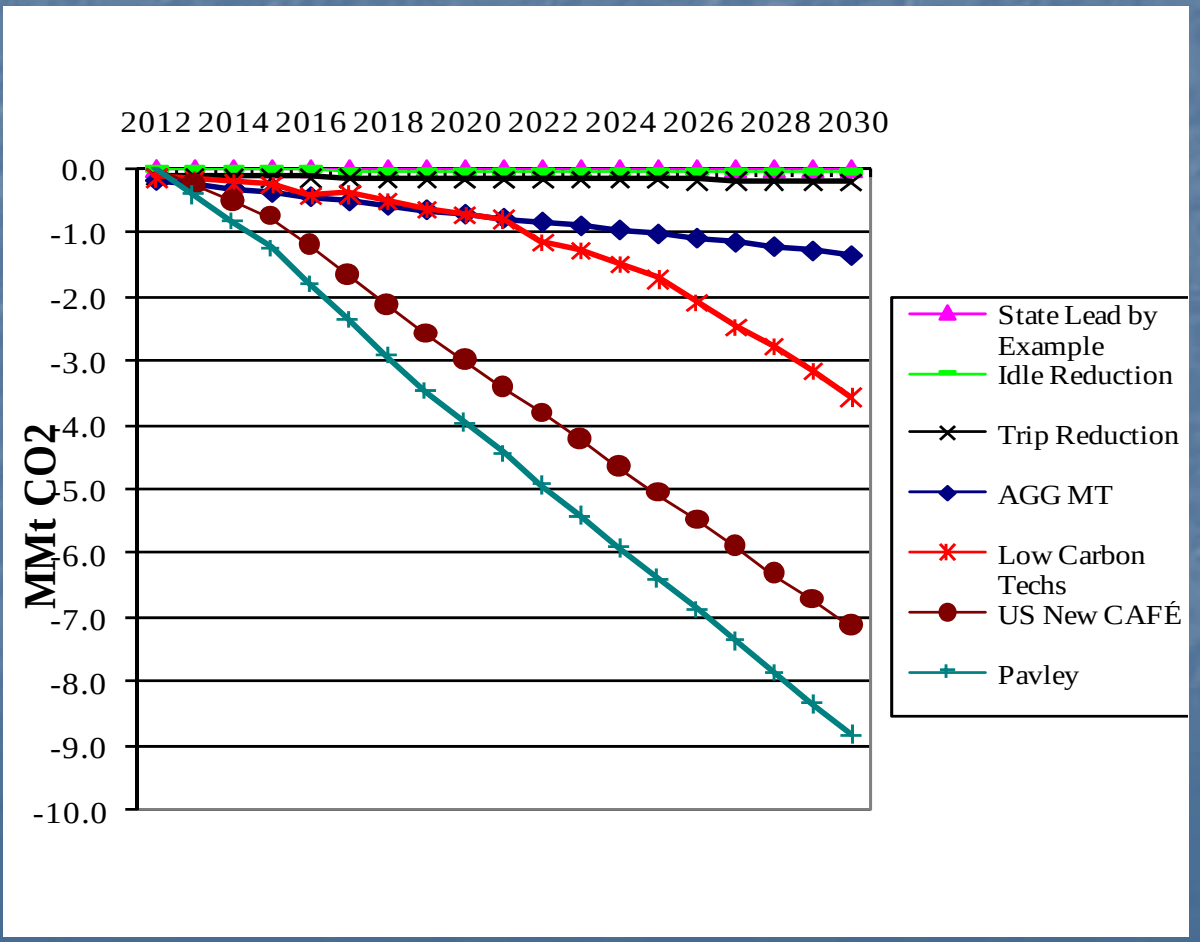
Transportation Baseline



Transportation Avoided Emissions



Transportation Avoided Emissions (With Clean Car)



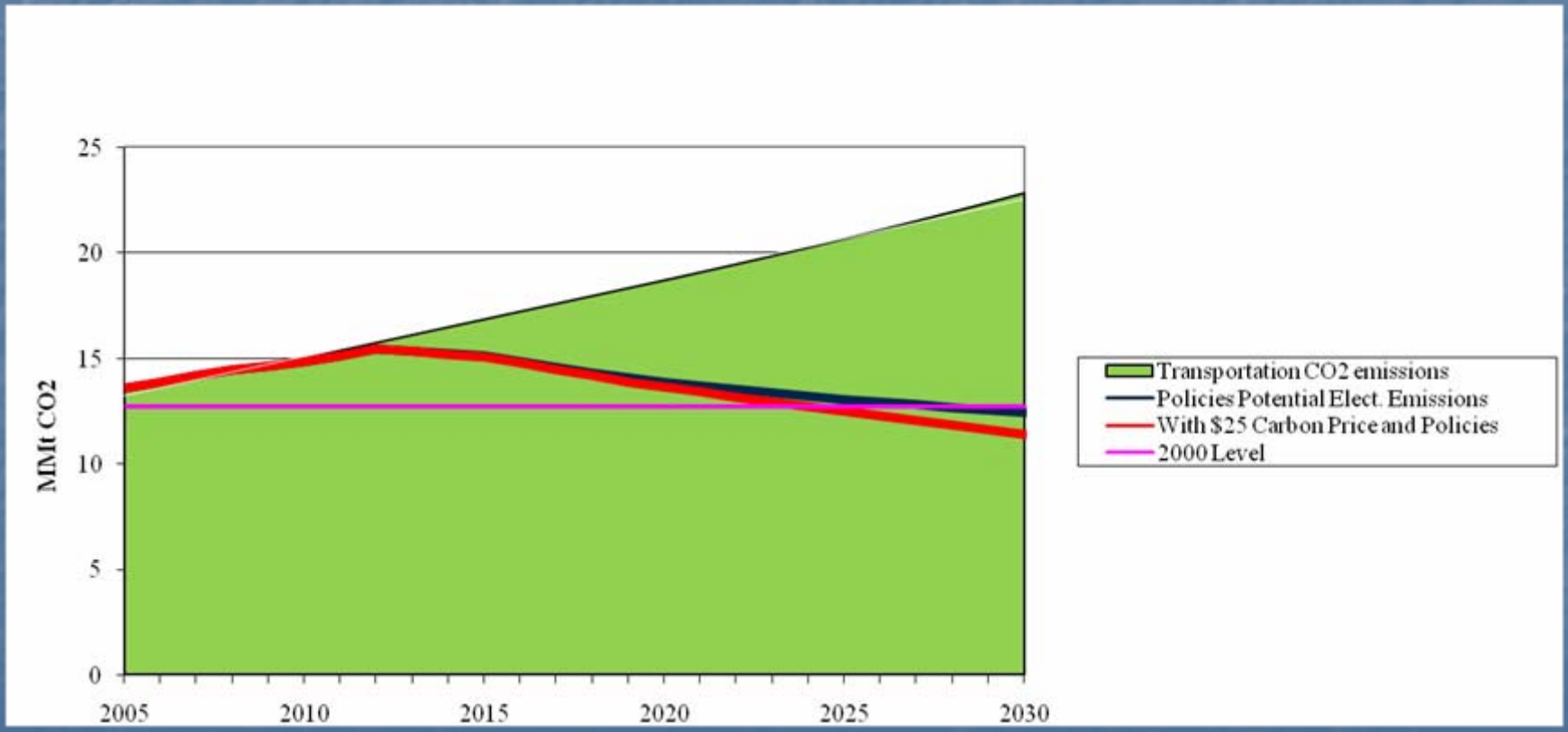
Annual Avoided Emissions (MMT)

	2020	2030	Levelized Cost $ / tonne
State Lead by Example	-0.01	-0.01	($3)
Idle Reduction	-0.04	-0.05	($69)
Trip Reduction	-0.16	-0.20	($539)
Aggressive Mass Transit	-0.72	-1.37	($315)
Low Carbon Techs	-0.72	-3.58	($55)
US New CAFE	-2.99	-7.13	-
Pavley (California Clean Car)	-3.96	-8.83	negative
Total (adjusted for overlap)	-4.88	-10.44	

Theme #2 – Policies Interact

- Overlap and synergy
  - Low Carbon Techs and Pavley/Clean Car
  - Mass Transit and Smart Growth
- Interaction impacts both costs and emissions

Transportation Strategies Combined



Electricity Sector and Building and Industrial Electricity Use

- Accounts for about 1/3 of Utah's GHG emissions
- Changes to these emissions generally require substantial investments
- Electricity unusual commodity

Theme #3 – Importance of Planning and Preparation

- Strategies based in future require laying the foundation far in advance
  - Importance of enabling strategies
- Example of carbon capture and sequestration

Why We Use a Model

- Captures complicated region-wide interactions
  - Trading, prices, emissions
- Compare to a spreadsheet approach

Modeling Methodology (Part I)

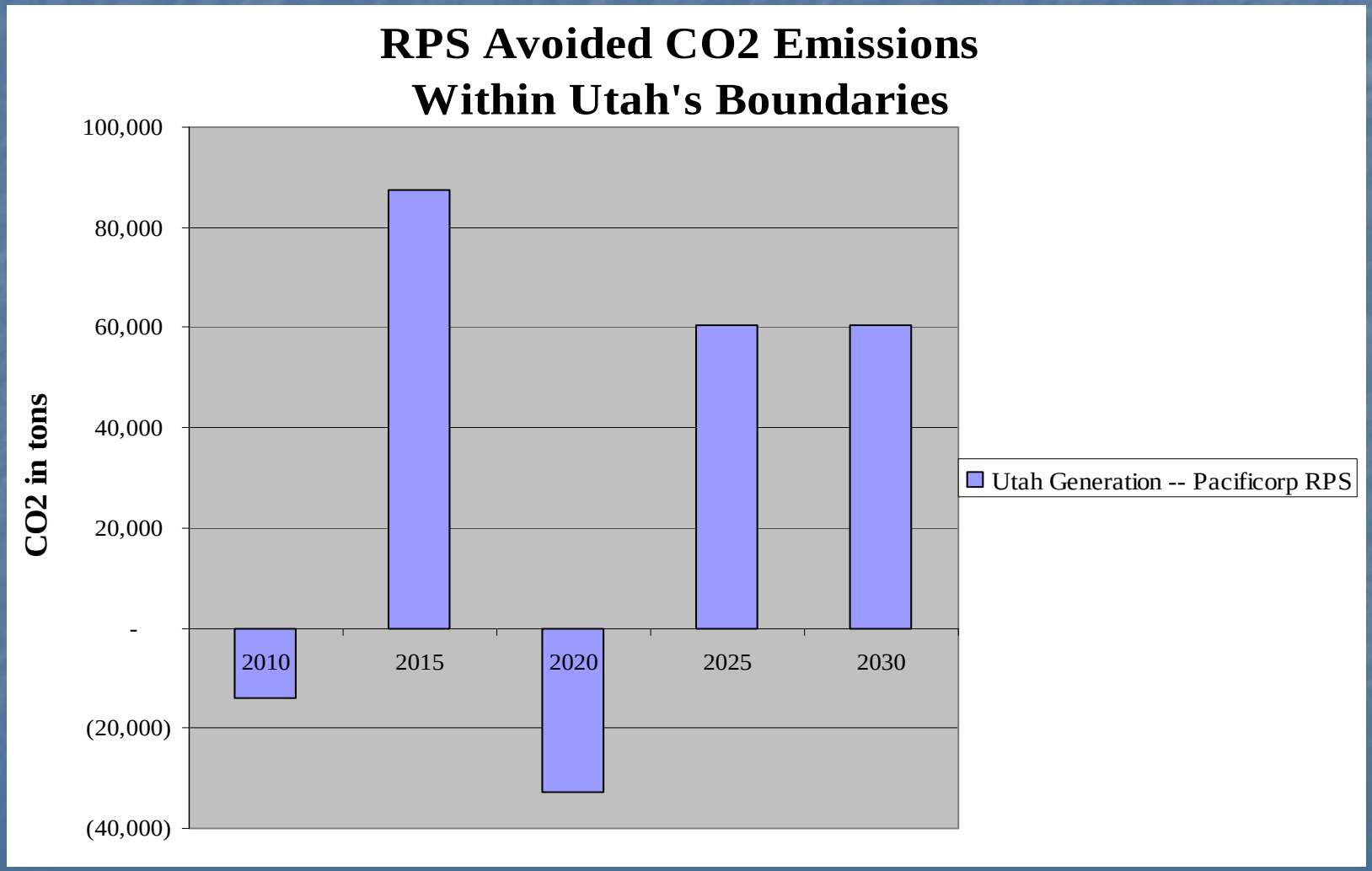
AURORA model allowed us to consider interactive market effects

Question:

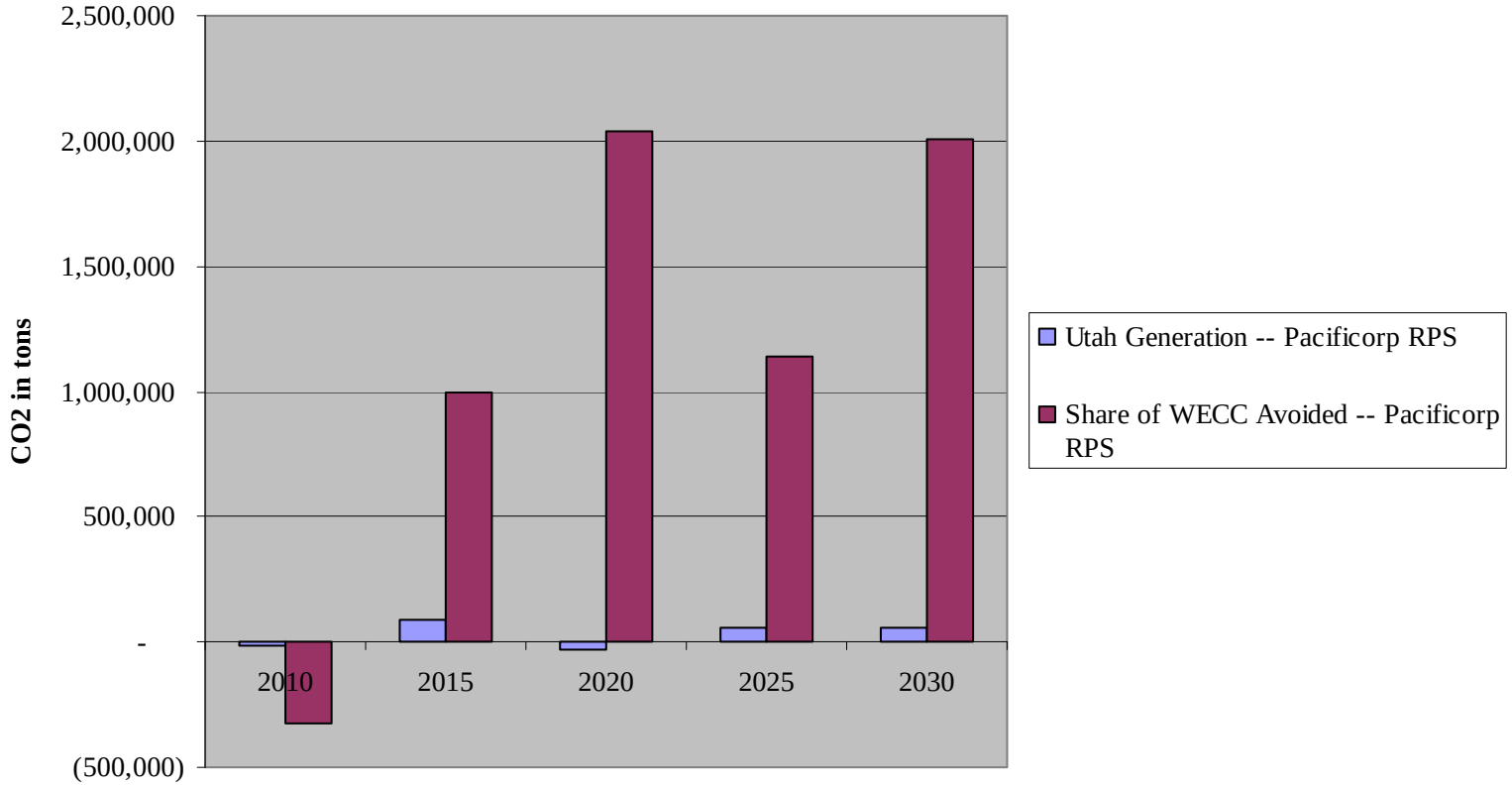
How should we count Utah's avoided emissions?

Modeling Methodology (Part II)

- Determined to capture cost and emissions effects WECC-wide and then count Utah's share.


RPS Avoided CO2 Emissions
Within Utah's Boundaries
CO2 in tons
100,000
80,000
60,000
40,000
20,000
-
(20,000)
(40,000)
2010
2015
2020
2025
2030
Utah Generation -- Pacificorp RPS

RPS Avoided CO2 Emissions
Utah versus "Utah Share" of Region



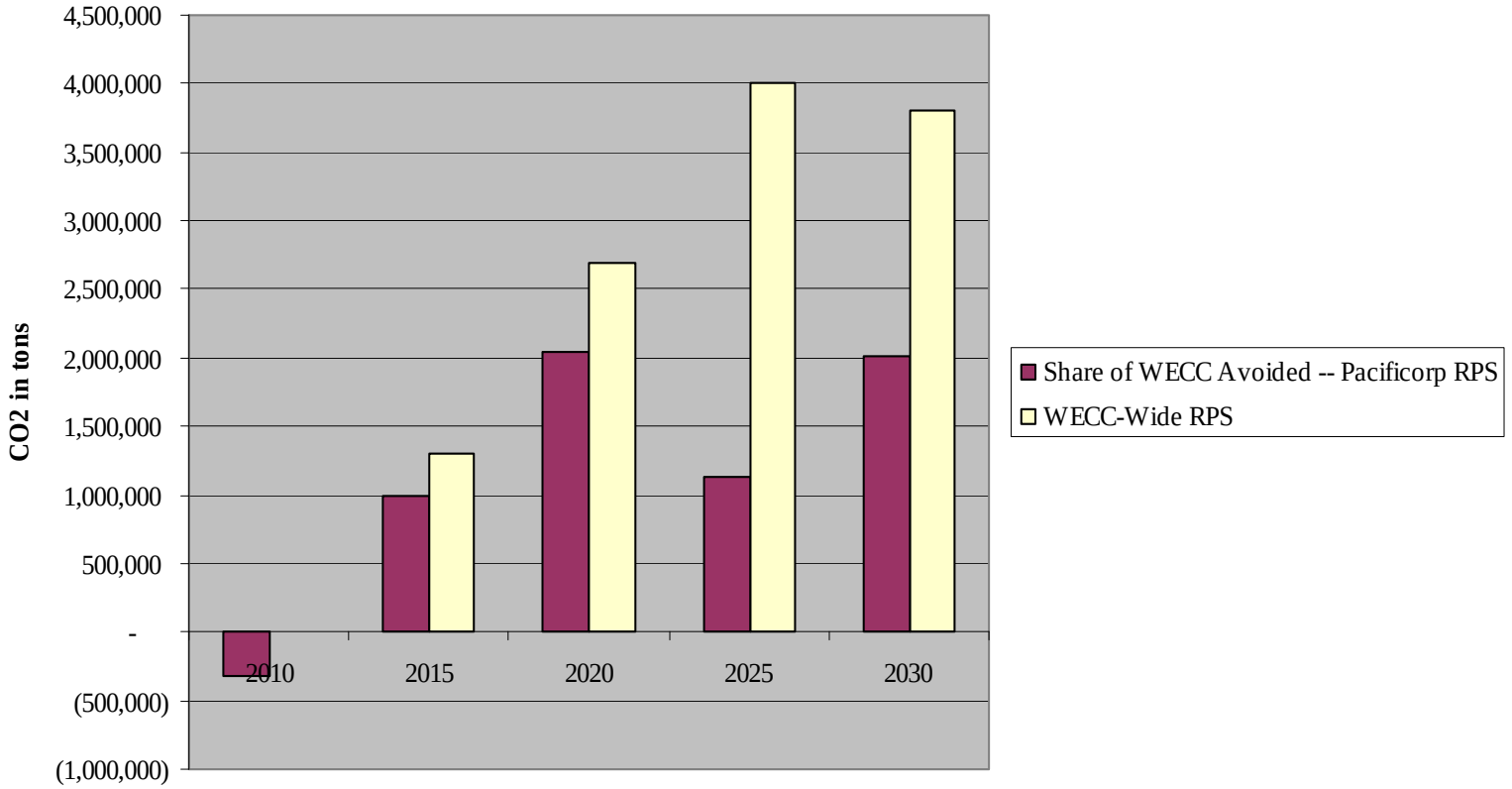
Follow-up Question:

Will Utah act alone or in concert with other states?

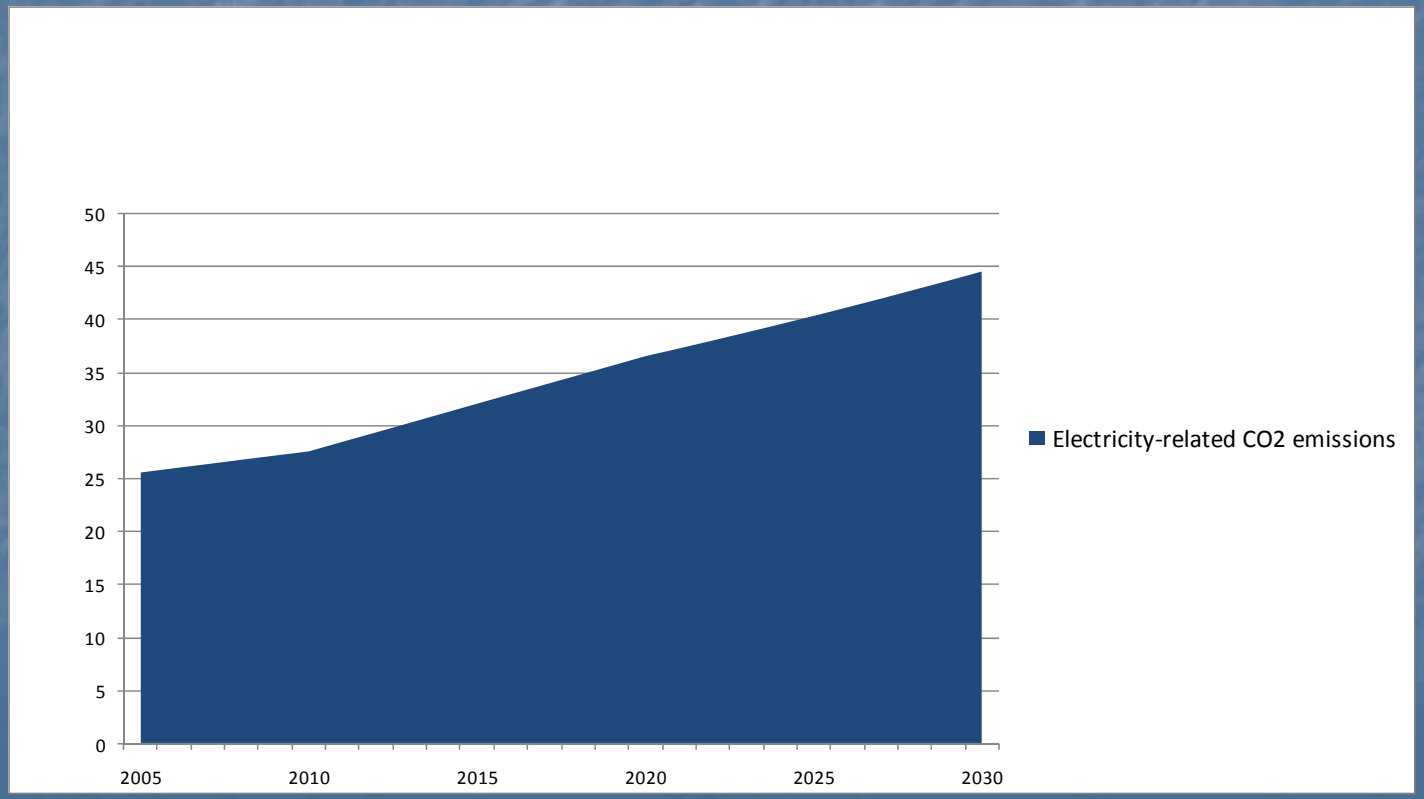
Modeling Methodology (Part III)

- We assumed WECC-wide action to be similar to that of Utah to accurately measure Utah's share

RPS Avoided CO2 Emissions
Utah Alone Versus Western Action



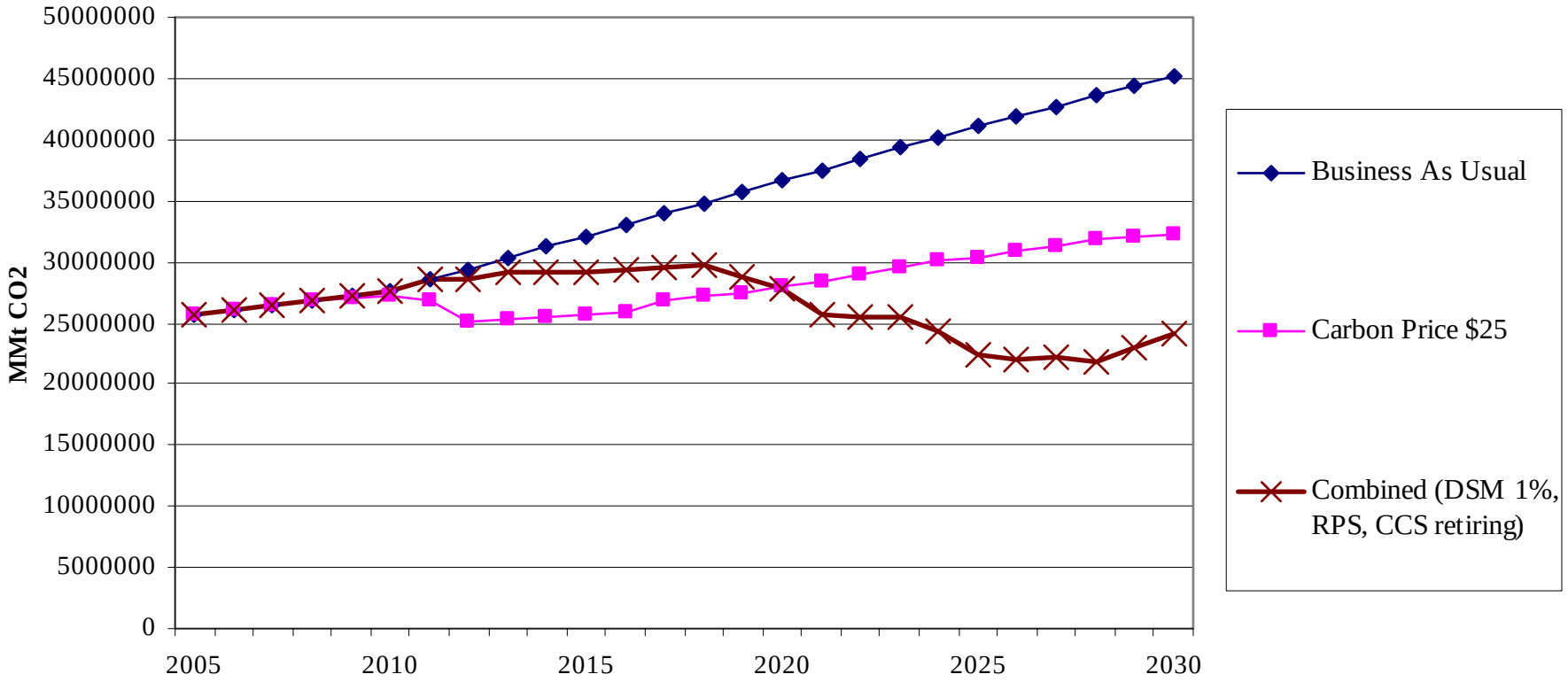
Electricity Baseline



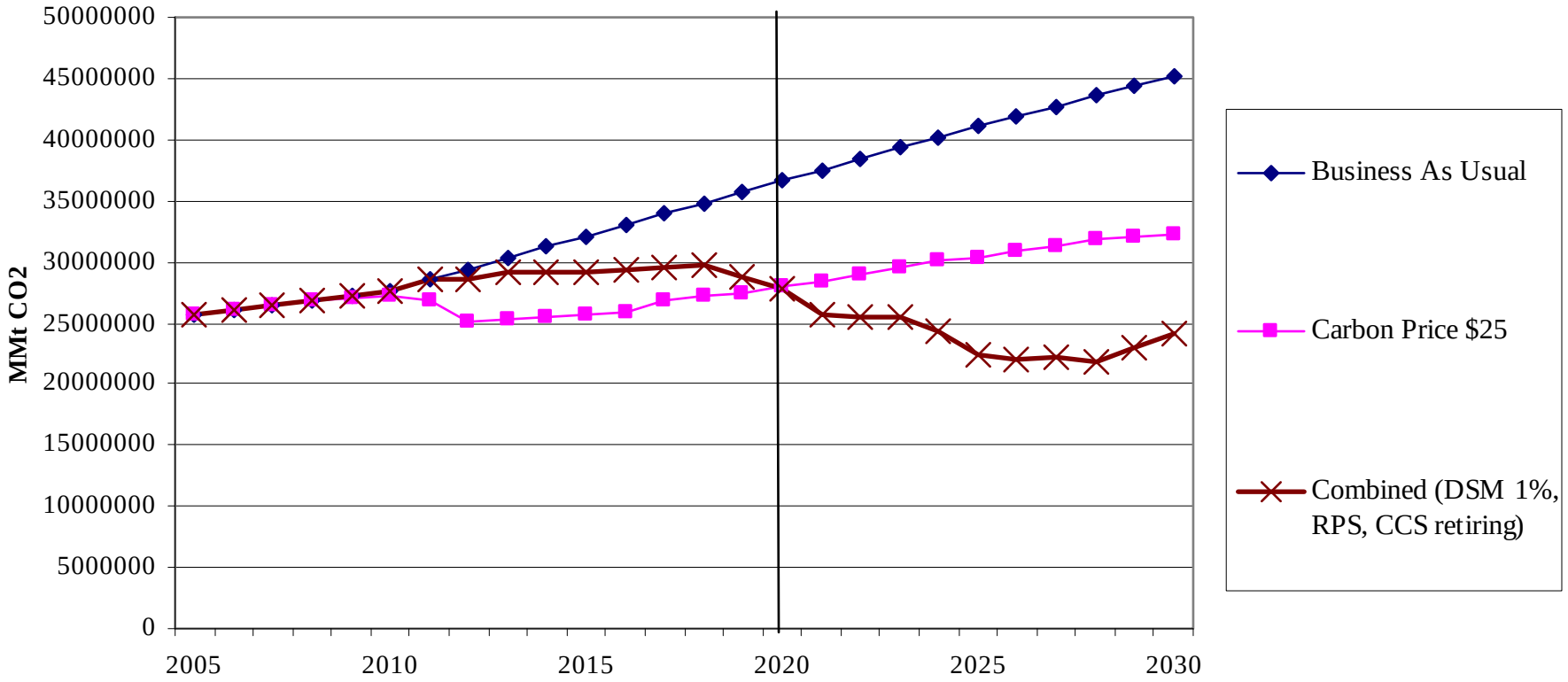
Applying Utah's Strategies WECC Wide

- RPS 20% across WECC
- CCS scales up based on Utah's ~ 11% share of coal generation. 1.3 GW to ~ 11 GW, aggressive CCS is 3.7 GW of replacement
- DSM scales up similar to Nuclear on a demand basis
- Utah's emissions avoided calculated by scaling down total WECC-wide avoided emissions by Utah's emissions from Inventory (~ 7 to 8.5%)

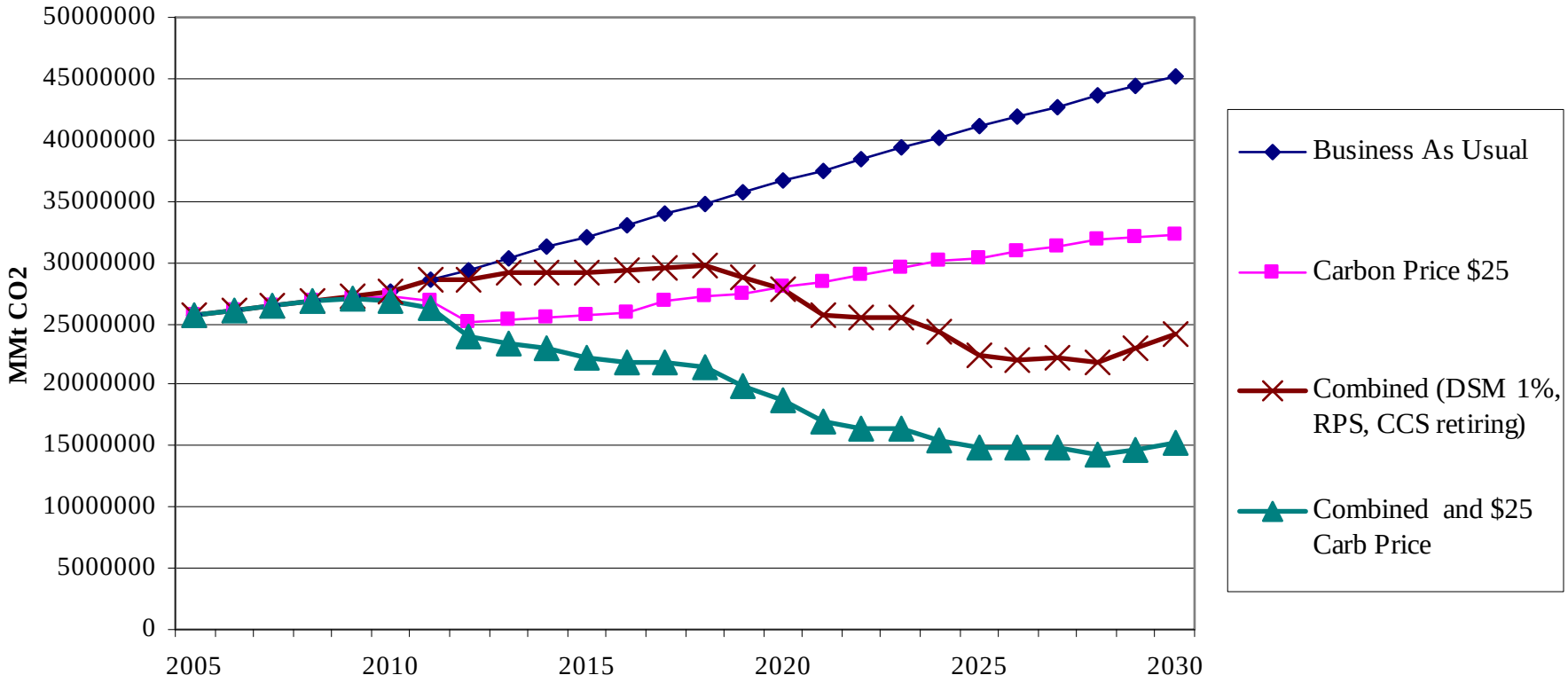
Electricity CO2 Emissions Polices

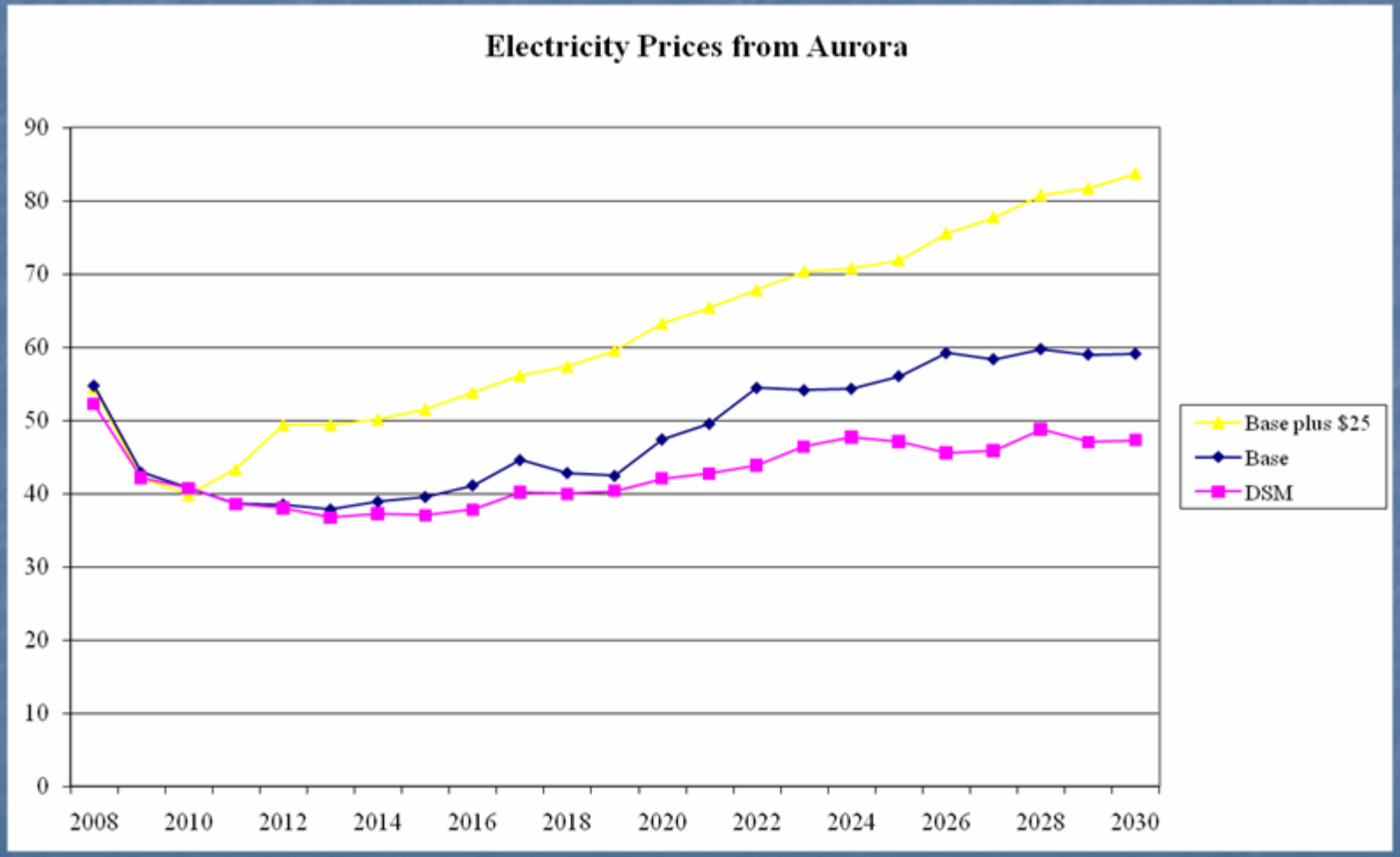


Electricity CO2 Emissions Polices



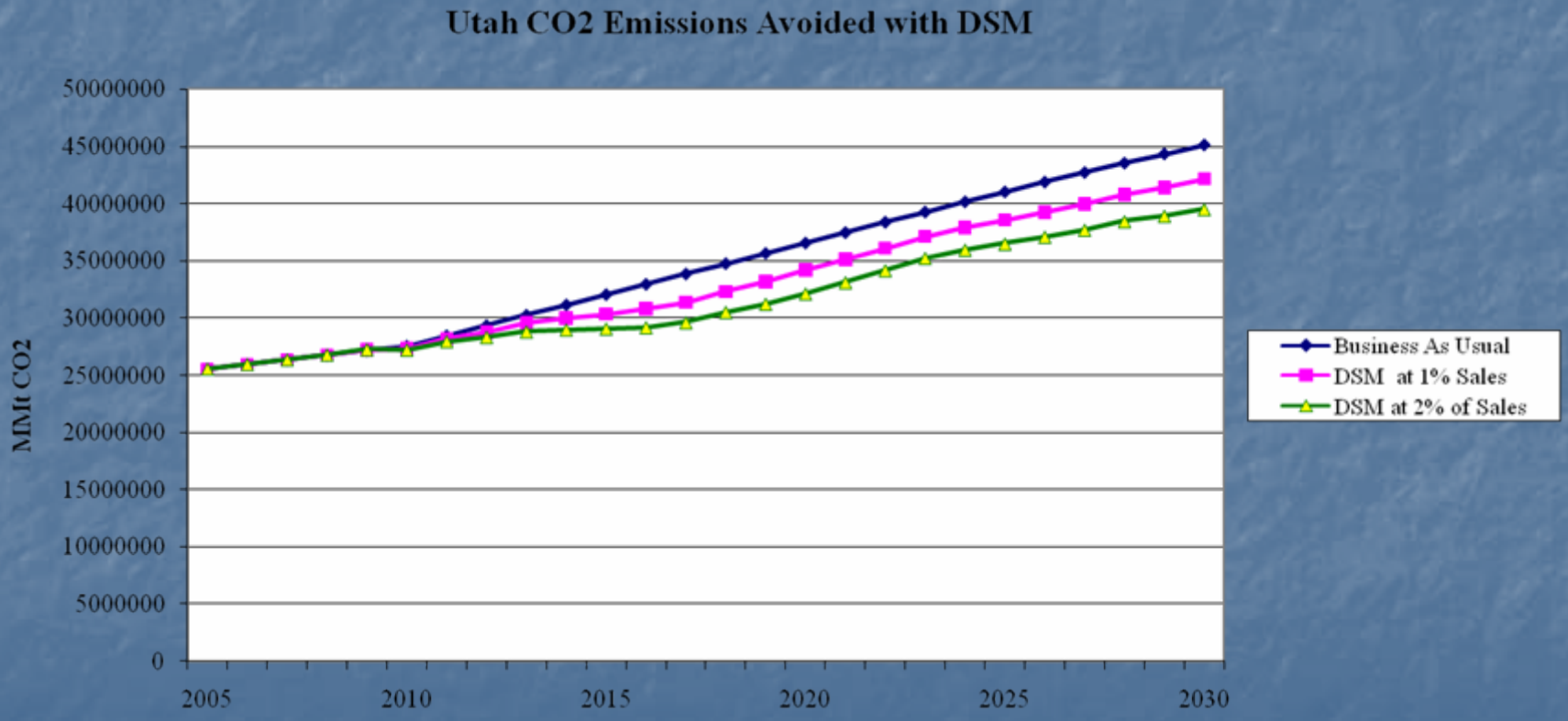
Electricity CO2 Emissions Polices



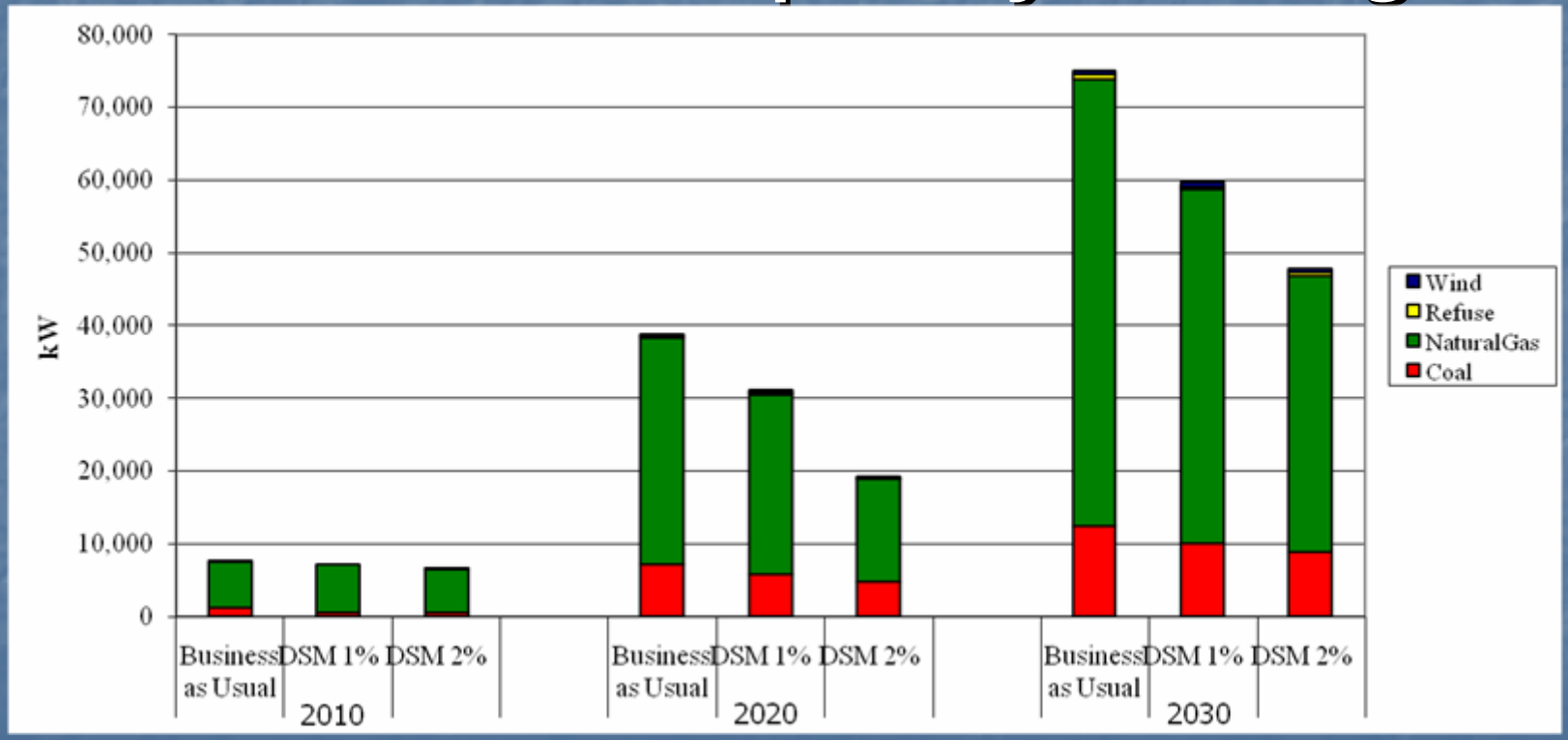

Electricity Prices from Aurora
90
80
70
60
50
40
30
20
10
0
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Base plus $25
Base
DSM

Going Deeper

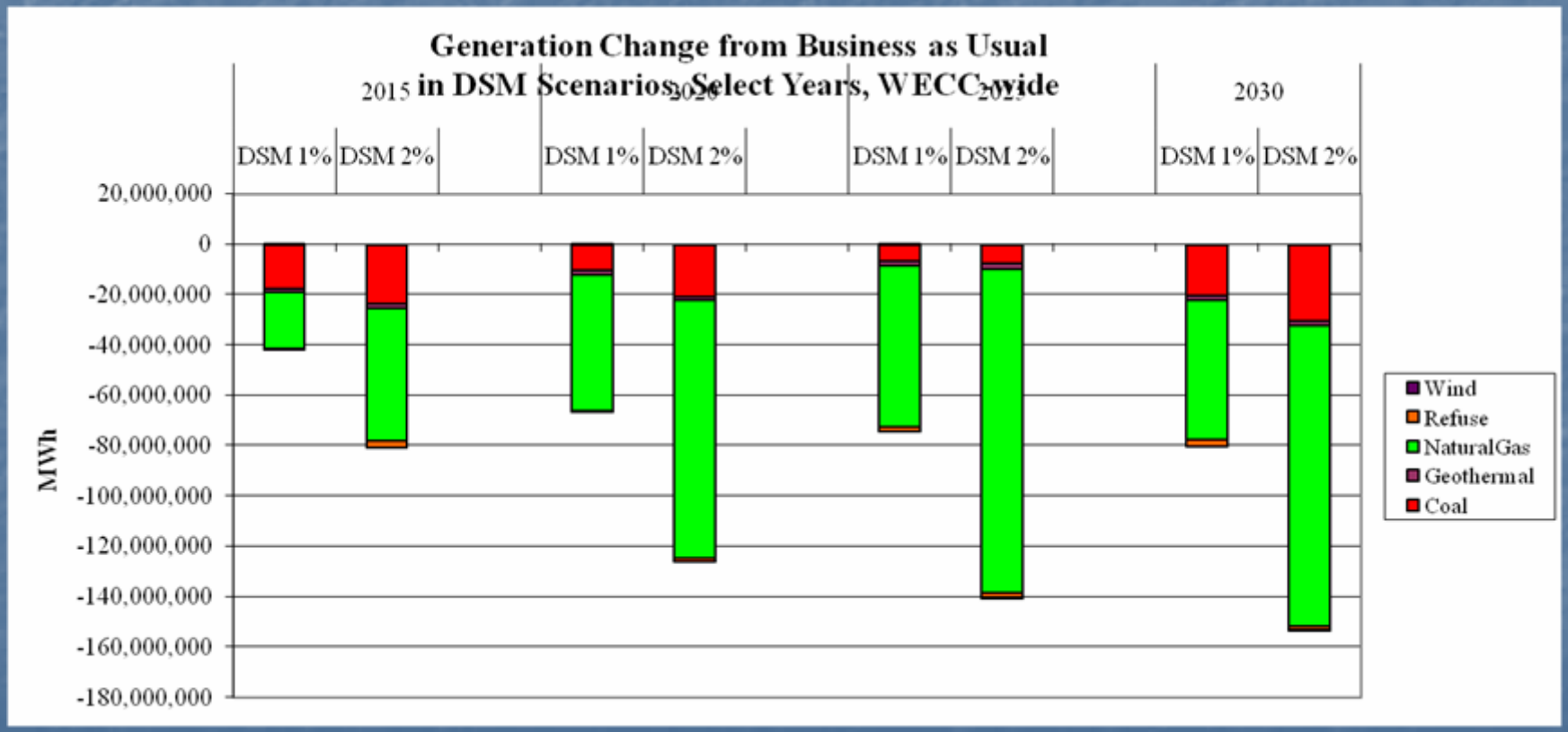
DSM In Depth (I): Avoided Emissions



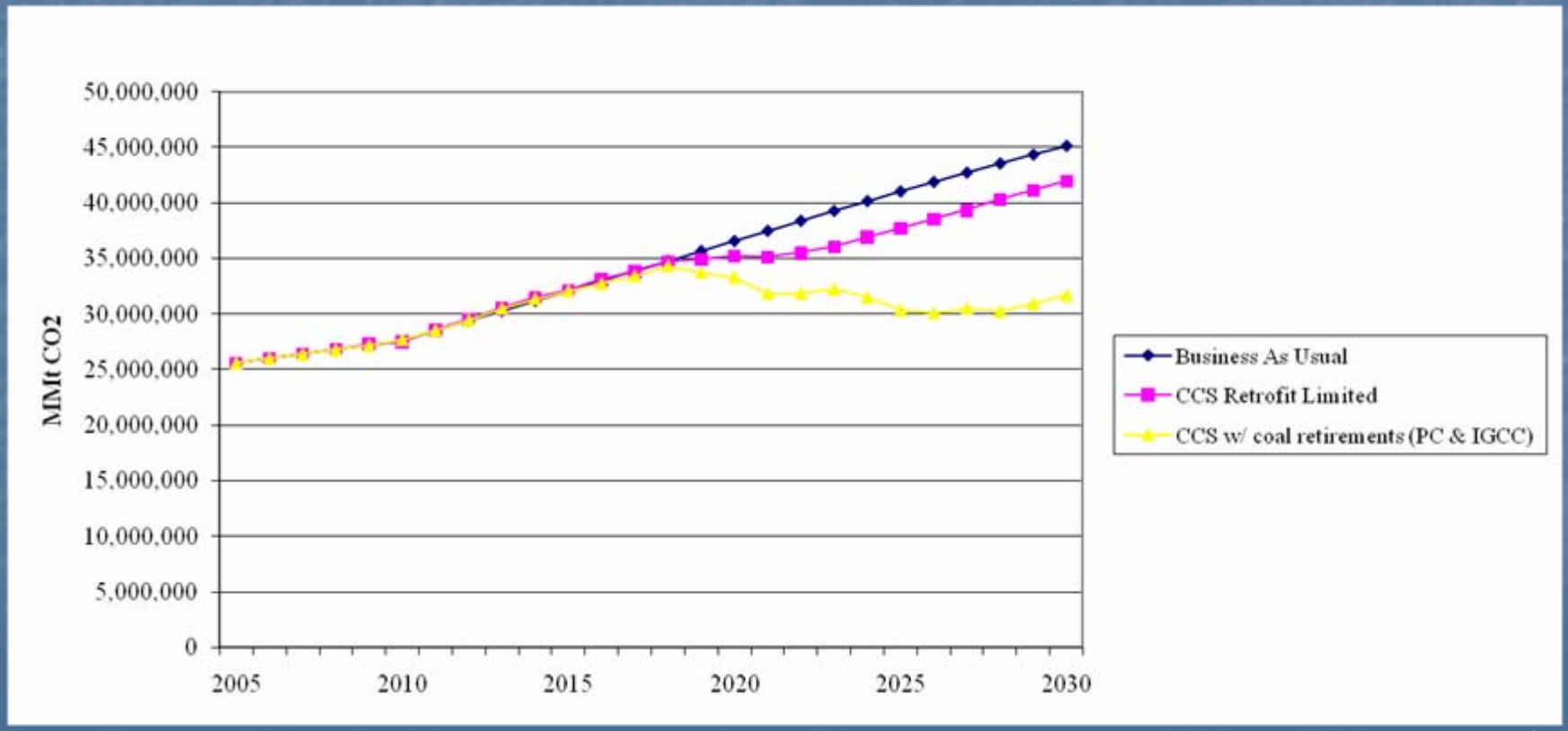
DSM in Depth (II): Alternative Capacity Changes



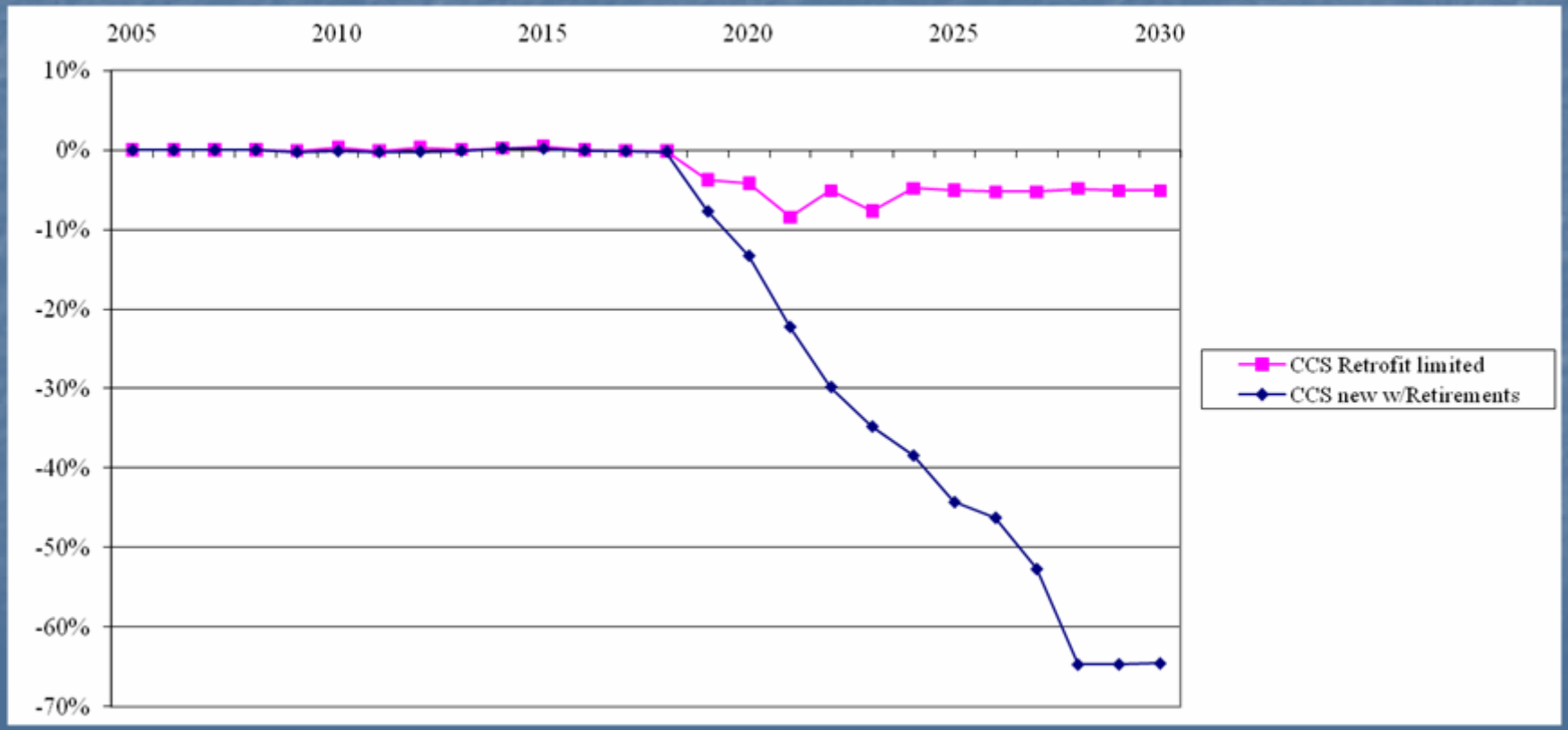
DSM In Depth (III): Generation Relative to Business as Usual



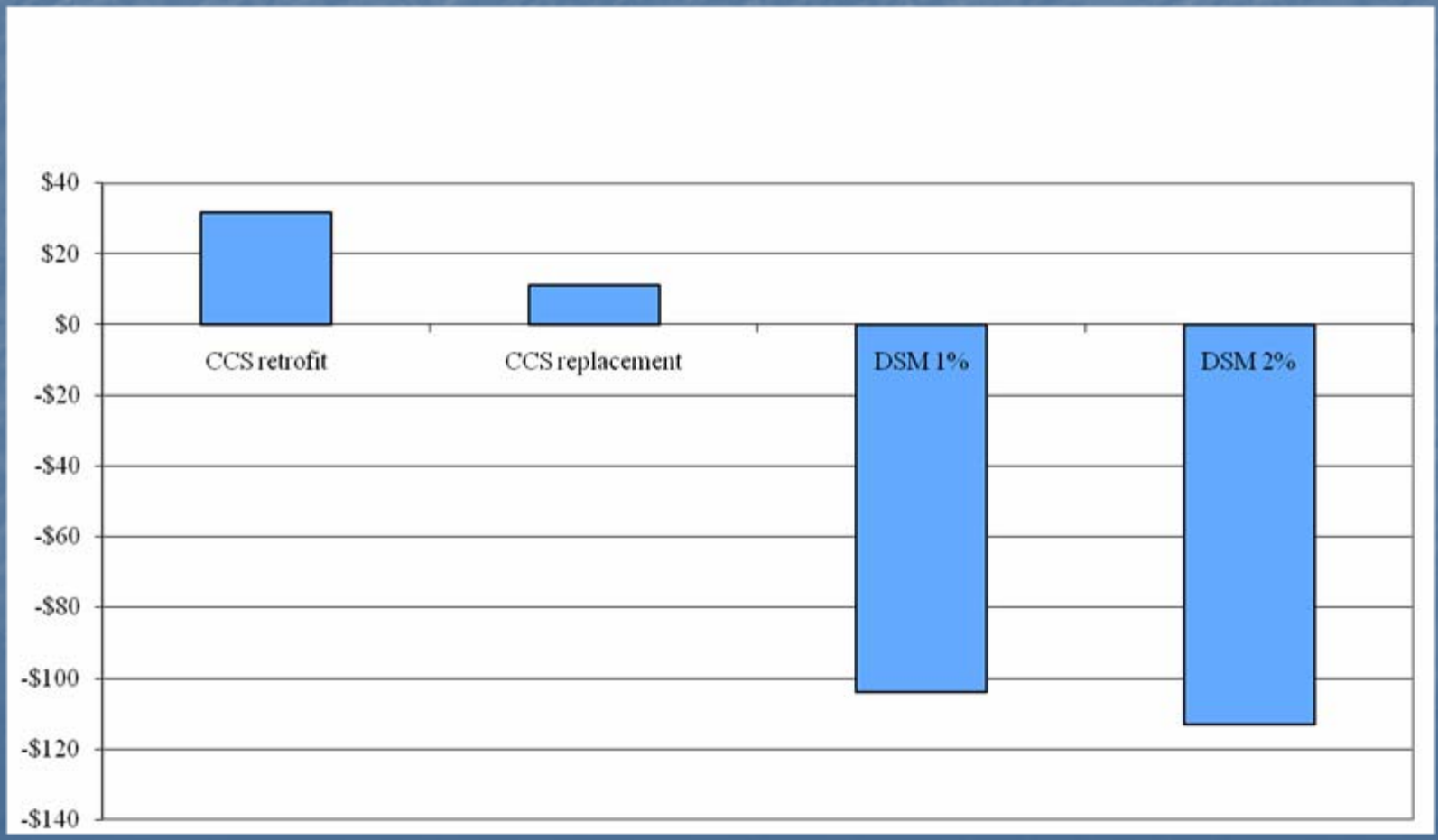
Emissions Avoided from Alternative CCS Penetrations



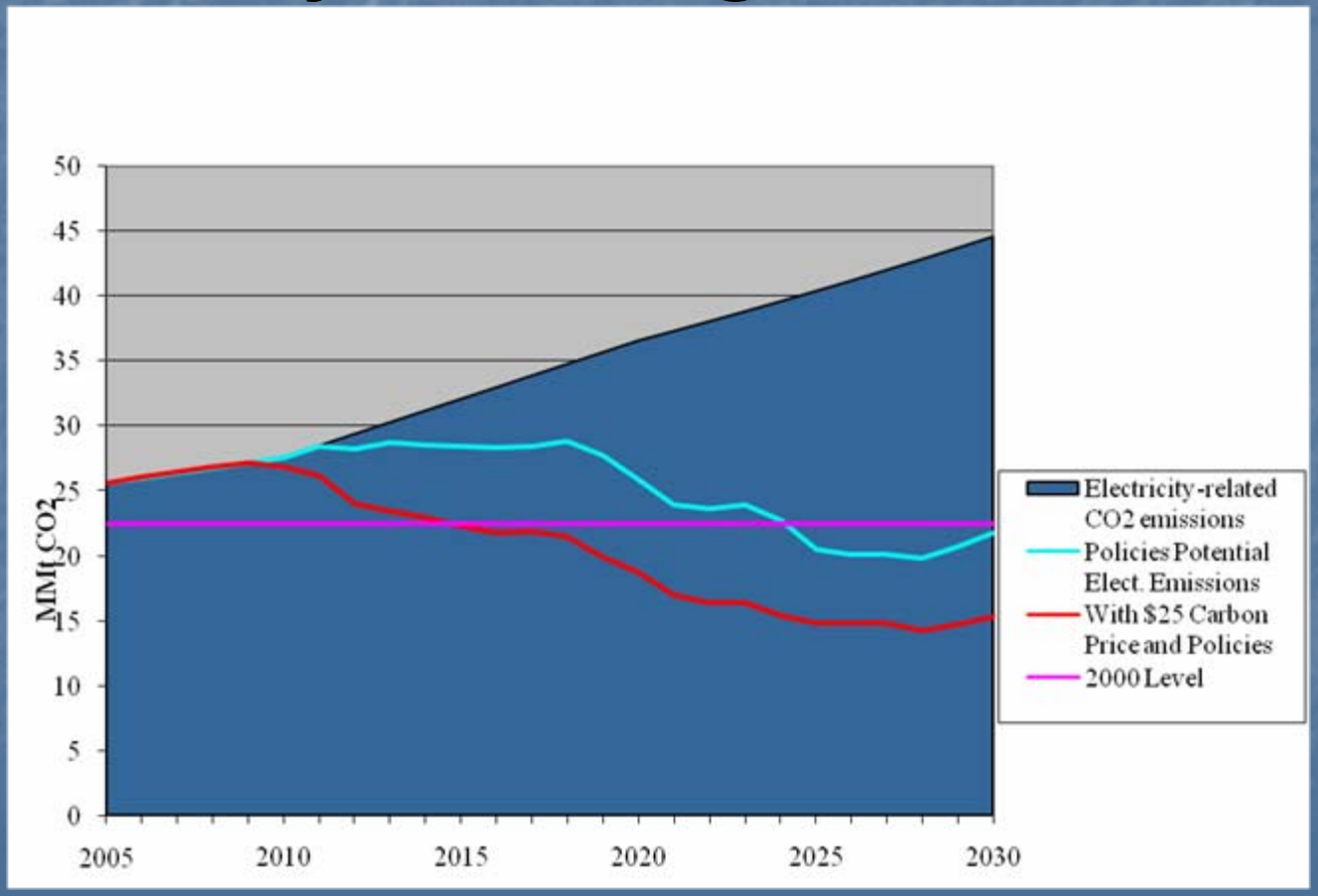
SO2 Emissions Co-Benefits from Alternative CCS Strategies

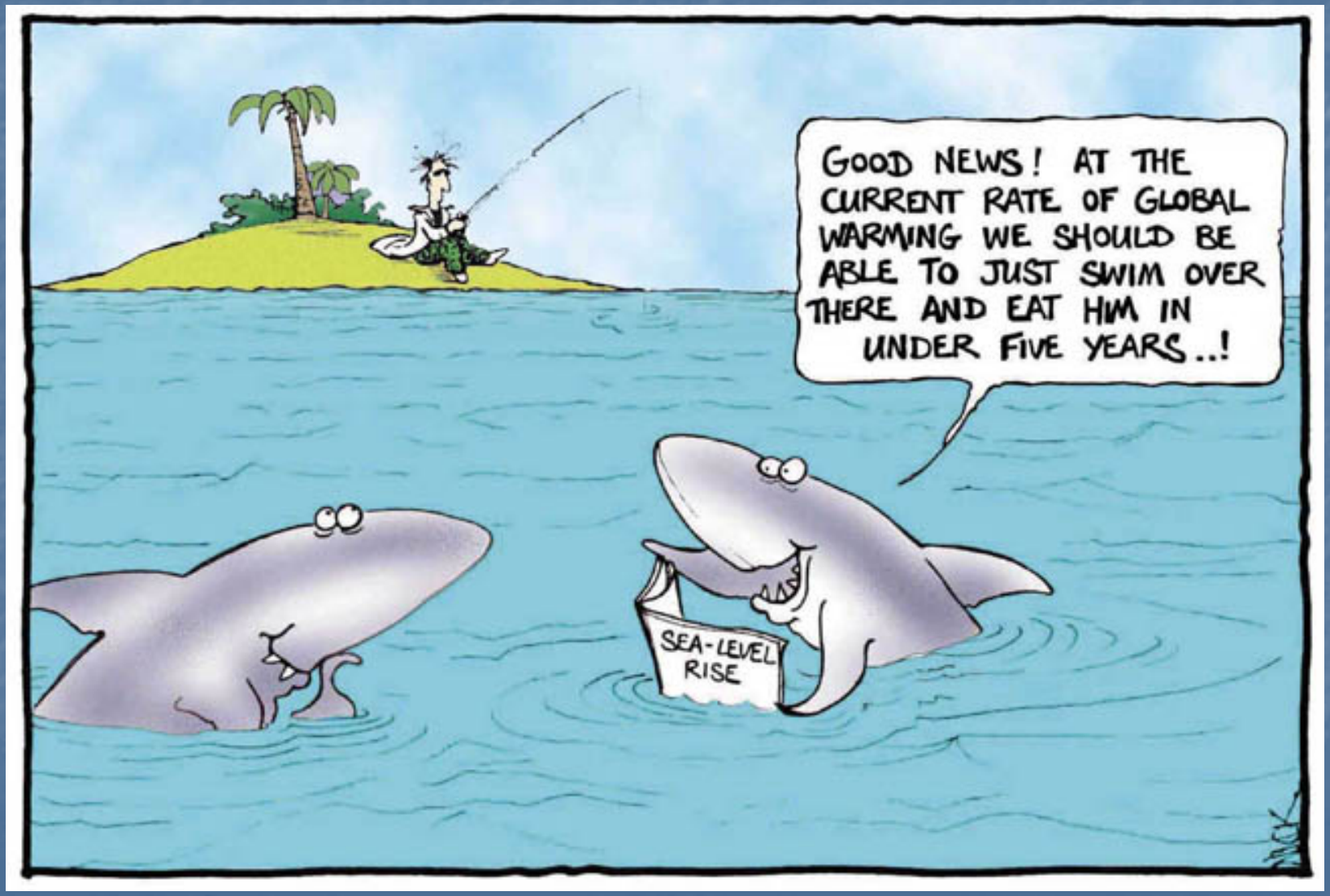


Cost Per Tonne of Avoided Emissions



Electricity Strategies Combined

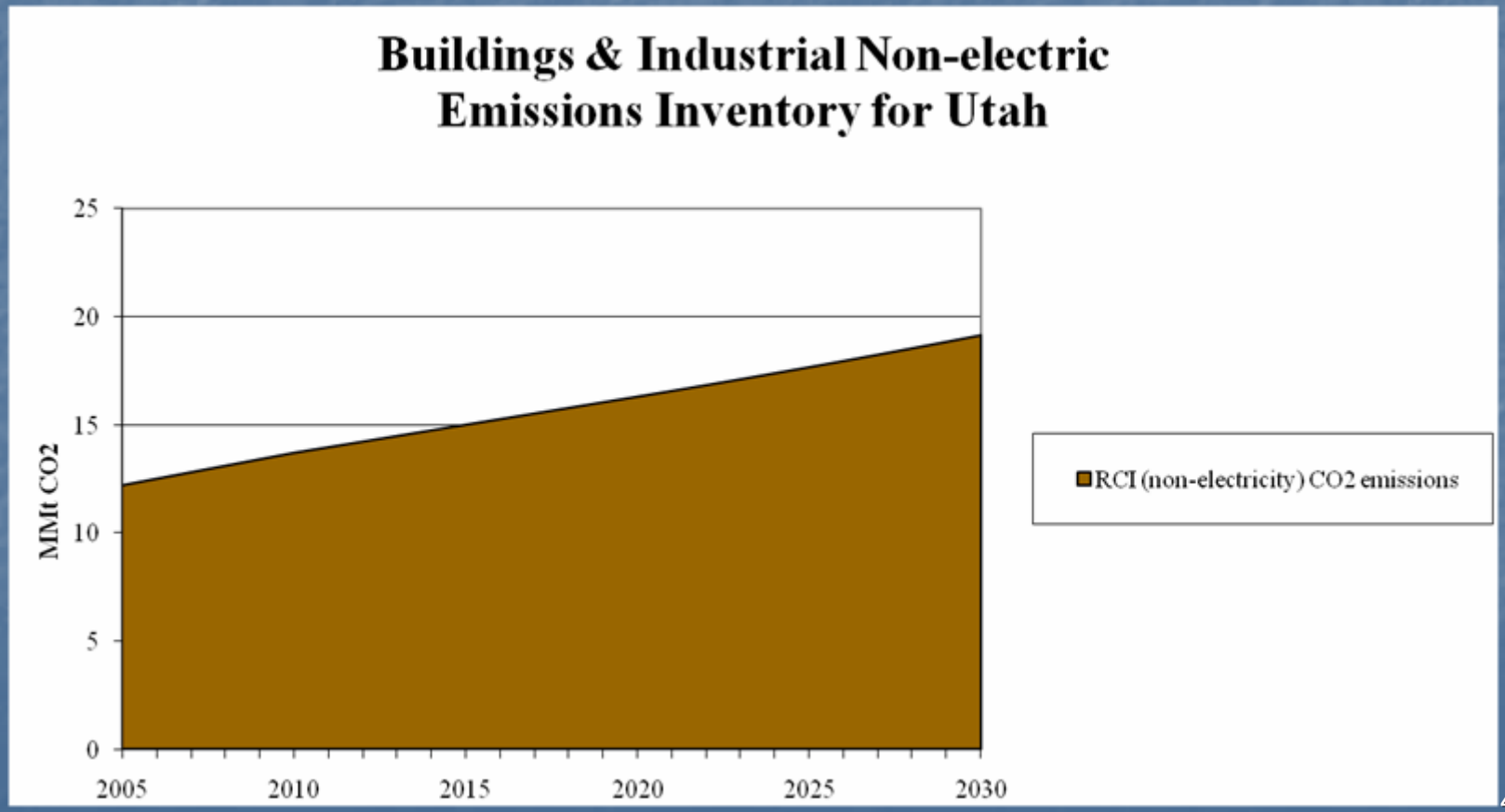



GOOD NEWS! AT THE CURRENT RATE OF GLOBAL WARMING WE SHOULD BE ABLE TO JUST SWIM OVER THERE AND EAT HIM IN UNDER FIVE YEARS..!
SEA-LEVEL RISE

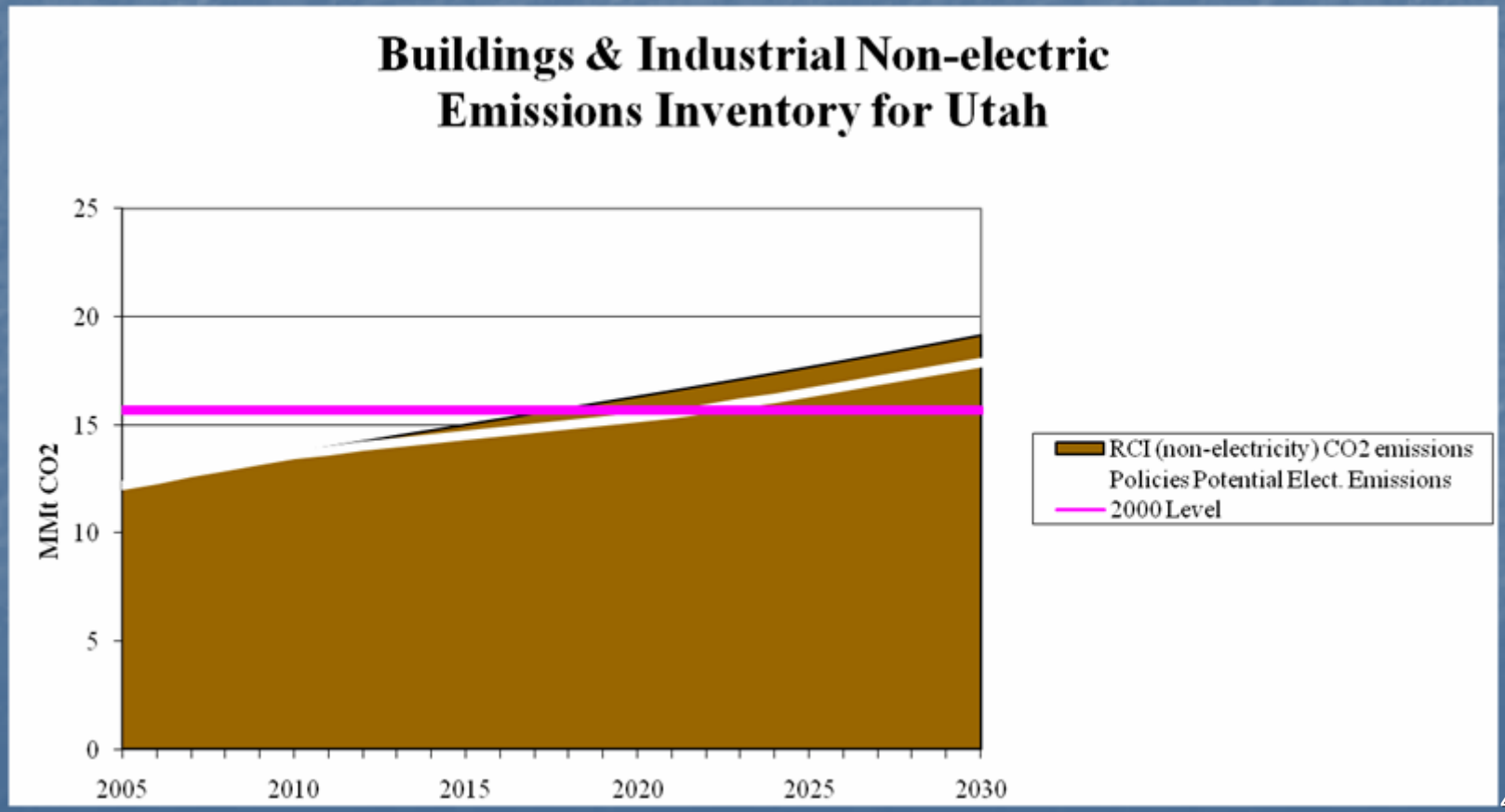
Building and Industry Non-Electricity Sector

- Approximately 1/6th of the emissions in Utah
- We only quantified one strategy that impacted it

Building and Industrial Non-Electricity Baseline



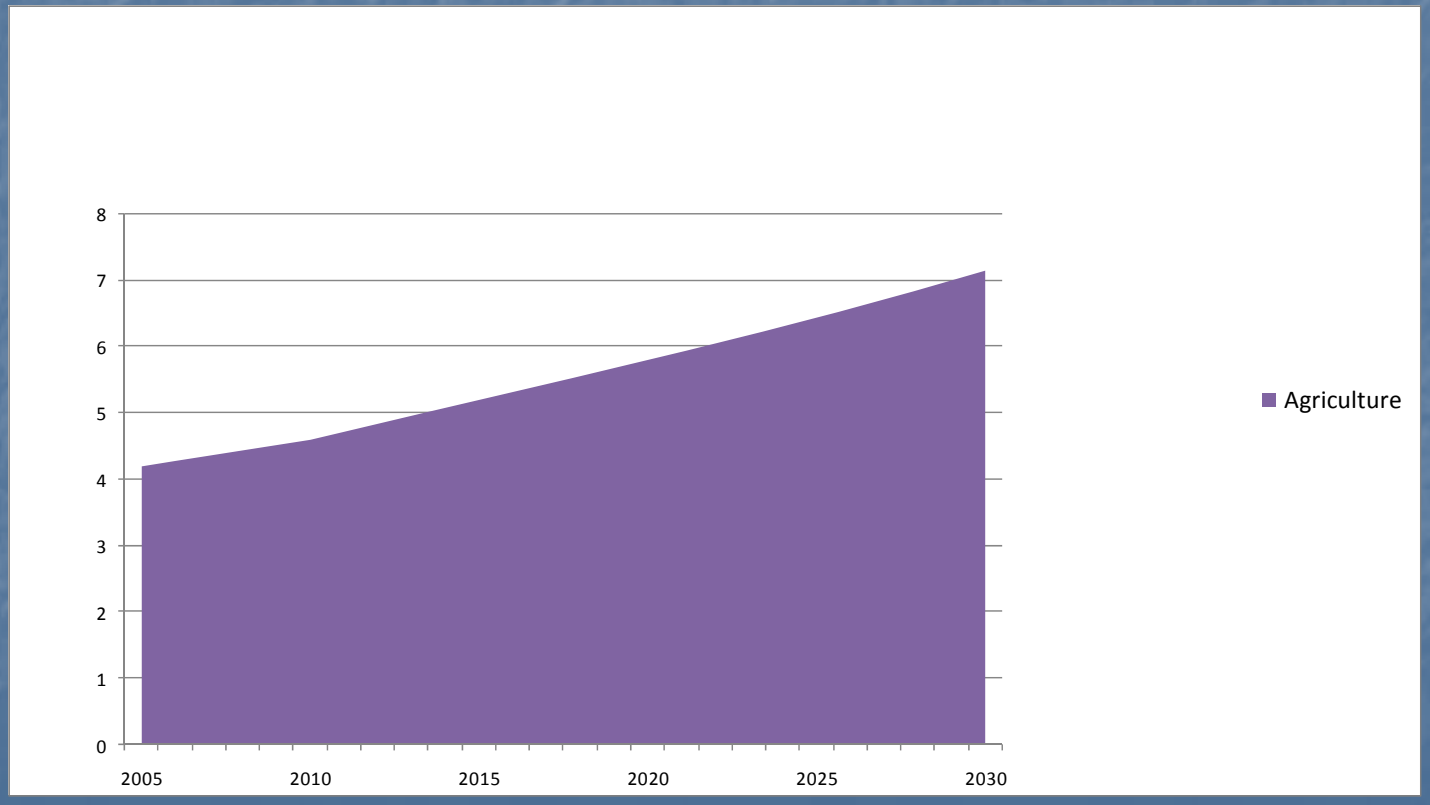
Building and Industrial Non-Electricity Strategies Combined



Agricultural Sector

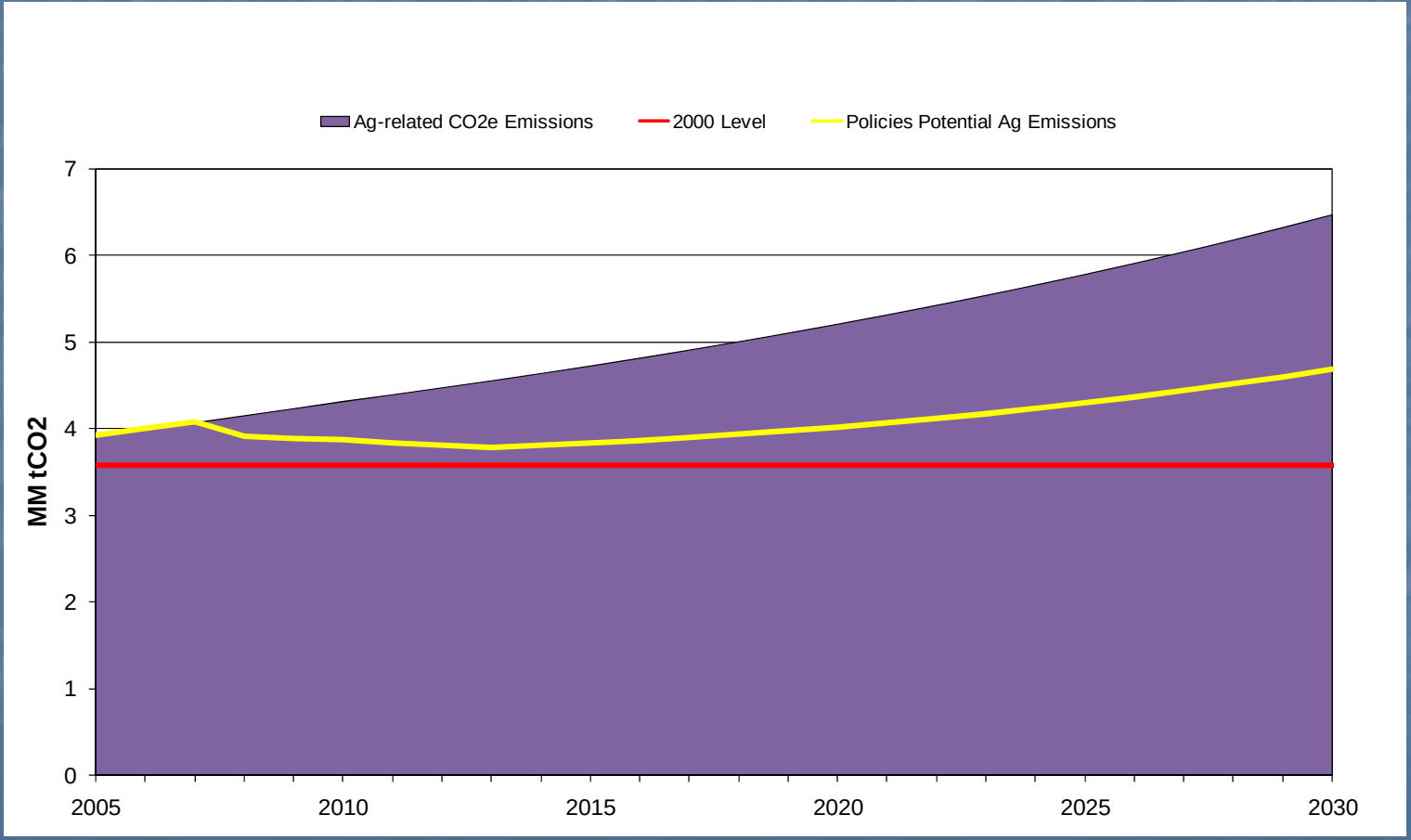
- Relatively small contributor to Utah's GHGs
- Spreadsheet approach to these strategies

Agriculture Baseline

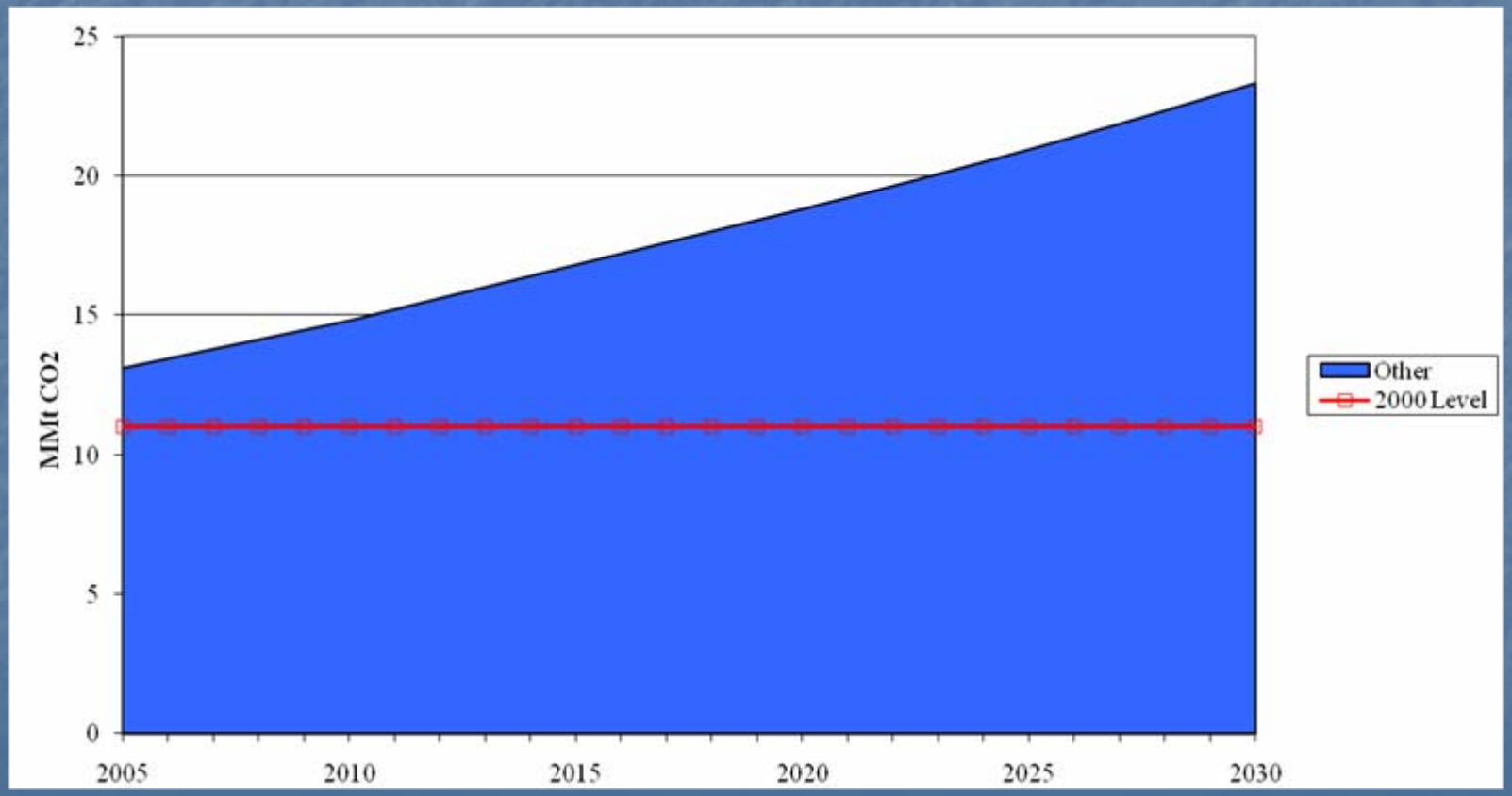


	2020	2030	Levelized Cost $ / tonne
Biofuels Production - Scenario A	-0.71	-1.31	$159
Biofuels Production - Scenario B	-0.71	-1.31	$38
Biofuels Production - Scenario C	-1.02	-1.87	$29
Manure Management (methane digesters)	-0.49	-0.49	$2
Total (Biofuels B + Methane)	-1.51	-2.36	

Agricultural Strategies Combined



Other Emissions



Thank You